P69

Investigation of high conductivity area at the interface between $Ba_{0.8}Sr_{0.2}TiO_3$ and $LaMnO_3$ after effect of electric field on $Ba_{0.8}Sr_{0.2}TiO_3$ ferroelectric film

D.P. Pavlov, N.N. Garig'yanov, A.V. Leontyev, T.M. Salikhov, V.V. Kabanov, R.F. Mamin

Zavoisky Physical-Technical Institute, FRC Kazan Scientific Center of RAS, 420029, Kazan, Russia
mamin@kfti.knc.ru

As it has been shown [1], the high conductivity area (quasi two dimensional electron gas) may be created at an interface due to electric polarization discontinuity [2, 3]. A quasi two dimensional electronic gas (q2DEG) is formed in the STO layers next to the interface which becomes superconducting below a temperature of 300 mK [1, 4]. Remarkably, the superconducting state coexists with a magnetic state being stable up to the room temperature. Ferroelectrics are attractive materials for such purpose. They have a wide range of different distinctive properties, among them: spontaneous polarization switching, high dielectric permeability, dielectric nonlinearity, piezo- and pyro- activity, linear and quadratic electro-optical effects. That can expand the scope of application in nanoelectronics. The direction of such polarization in the ferroelectric film might be switched by an external electric field.

Antiferromagnetic $LaMnO_3$ (LMO) might be transferred to ferromagnetic state by increasing the concentration of free carriers by injection. The change of domain structure in ferroelectric $Ba_{0.8}Sr_{0.2}TiO_3$ (BSTO) film can change a concentration of free carriers on the interface with LMO reis means that increasing the free change carriers might lead to the local ferromagnetic state and magneto-resistivity in a system with q2DEG. Therefore, there is an opportunity to switch conductivity of interface by an electric field in the heterostructure BTO/LMO.

In the present work the thin film of epitaxial BSTO was sputtered on the top of LMO single crystalline samples using the magnetron sputtering technique. Conductivity measurements were performed by a four-point probe method. Measurements were performed before and after effect of electric field on $Ba_{0.8}Sr_{0.2}TiO_3$ ferroelectric film. We have shown that when a non-uniform electric field is applied to a ferroelectric film, we can turn off the state with high conductivity. And under the influence of a uniform electric field on the ferroelectric film, we can turn on the state of high conductivity.

The reported study was funded by Russian Scientific Foundation, research project No. 18-12-00260.

1. A. Ohtomo, and H. Hwang, *Nature* **427**, 6973 (2004).
2. M. K. Niranjan, Y. Wang, S.S. Jaswal, E.Y. Tsymbal, *Phys. Rev .B* **103**, 016804 (2009).
3. K.D. Fredrickson, A. Demkov, *Phys. Rev. B* **91**, 115126 (2015).
4. N. Reyren, S. Thiel, A. Caviglia et al., *Science* **317**, 5842 (2007).